REMARKS

The acceptance of the amended drawings filed on July 8, 2009 is noted with appreciation.

Claims 1 - 20 remain active in this application. Claim 1 has been amended to correct an inadvertent spelling error. Claims 1 and 14 have been amended to clarify and emphasize the novel and meritorious features of the invention in a manner suggested by the Examiner. In particular, that the stressed film *concentrates compressive forces at the boundary* defined by a structure on a surface of semiconductor material. Support for this amendment can be found throughout the specification, particularly at paragraphs 0027-0028 and Figures 3A and 3B, as well as in the Abstract, in the application as published. No new matter has been introduced.

Claims 1-6, 14-18 and 20 have been rejected under 35 U.S.C. §102 as being anticipated by U.S. Patent 5,525,529 to Guldi. Claims 7-12 and 19 have been rejected under 35 U.S.C. §103 as being unpatentable over Guldi in view of U.S. Patent 6,159,813 to Ahmad. Claim 13 has been rejected under 35 U.S.C. §103 as being unpatentable over Guldi in view of U.S. Patent 6,882,025 to Yeo. These grounds of rejection are respectfully traversed for the reasons of record and, particularly, in view of the amendments above and remarks below.

To summarize, the present invention is directed to modifying the diffusion rate of boron, or other impurities which diffuse more rapidly than phosphorus or arsenic, in selected regions of a semiconductor material to approximate lower diffusion rates of other impurities. This is achieved by selectively reducing the diffusion rate at the edge of a gate structure (i.e., "boundary") with a film that *concentrates compressive forces* at the boundary such that the resulting stress applied to an adjacent underlying region of the semiconductor significantly reduces the diffusion rates (see paragraphs 0027-0028). As shown in Figure 3B, after annealing to activate the implanted impurities, diffusion 50 under the gate 14 is significantly reduced (differently) in both lateral and vertical directions as compared to the diffusion of Figure 3A. None of the cited references, either alone or in combination, teach or suggest the meritorious features of the claimed invention.

Guldi does not teach a method or structure for *concentrated* application of compressive stress, let alone application of such stress at a boundary. Rather, in order

to reduce dopant diffusion, the Guldi disclosure teaches applying films of different chemical compositions to semiconductor regions. As discussed at column 3, lines 42-67, interstitial sites or vacancies in the source/drain regions are suppressed by *adjusting the chemical composition* of the overlying blocking layer ("Nitridation of the screen layer promotes vacancy formation in the underlying silicon, thus retarding source/drain drive."). That is, Guldi uses adjustments of chemical concentration in the lattice structure for control of diffusion rate in a manner which does not appear to be localized or selective between impurities. As clearly stated at column 3, lines 4-8 (with emphasis):

> Vertical and lateral diffusion is suppressed *by controlling the silicon interstitial concentration* during source/drain anneal by *application of a film of a specified composition* over the source/drain *regions* for use during the anneal process.

It is, thus, plainly clear that Guldi does not and cannot teach the claimed invention because Guldi fails to recognize that applying a stressed film that concentrates compressive forces at a boundary will result in lower diffusion rates or, conversely, to use the *combination* of a boundary and a stressed film to concentrate compressive force, particularly for reducing diffusion rates.

As discussed at paragraphs 0027-0028 in the present invention, and shown in Figures 2-3B, application of a tensile film at a boundary that develops a *concentrated* compressive force in the semiconductor material directly underlying the tensile film will result in the opposite sign of the stress in adjacent areas, and vice-versa, as well as tensile stress in a region closely adjacent to the boundary. In other words, concentrated application of compressive stress in a region of semiconductor material will be accompanied by an adjacent region of tensile stress (see regions 110 and 120 in Figure 2). Concentrated application is achieved by defining a boundary with a structure (e.g., gate structure) on a surface of the semiconductor material. Thus, the effects of concentrated application of stressed film modifies the impurity diffusion rate as shown in Figures 3A-3B *without* having to adjust chemical compositions as in Guldi. These features are clearly disclosed in claims 1 and 14, as amended,:

> *...wherein compressive forces developed by said stressed film are concentrated at said boundary.*

With regard to claim 20, while Guldi does address differences of vertical and lateral diffusion, at no point does it address a boron concentration profile of *an extension region, formed by implantation with boron*, in a lateral direction differs from a vertical direction. Rather, as previously discussed, vertical and lateral diffusion in Guldi is controlled by *the silicon interstitial concentration* during source/drain anneal by *application of a film of a specified composition* over the source/drain *regions* for use during the anneal process. Thus, it is clearly shown that Guldi does not, and cannot, answer the explicit recitations of the claims, as amended, since Guldi neither anticipates nor renders obvious the meritorious features of the claimed invention.

Neither of the remaining references cited by the Examiner answer the deficiencies of Guldi, admitted or otherwise. Ahmad, disclosing nothing more than the problems the present invention solves, addresses implanting a boron halo to optimize concentration of p-type charge carriers. It is well known that there is a high diffusion rate of boron in halo implants. Because of this high diffusion rate, use of extremely narrow spacers for self-aligned source/drain implants are avoided. In the present invention, however, such spacers are important to maintaining a low external resistance for the transistor while a larger spacer also tends to increase overall size of the transistor (see paragraphs 0007 and 0025). In fact, as discussed in the previous response of record, it would be counterintuitive to one skilled in the art to combine a reference directed to applying films of different chemical configurations to semiconductor regions in order to reduce dopant diffusion (Guldi) with a reference that side-steps any sort of diffusion rate control because an impurity is implanted later in processing of a sub-half-micron MOSFET (see column 4, lines 43-62 in Ahmad). Thus, even if properly combinable, the combination of Guldi and Ahmad would still not teach the claimed invention, as amended, since neither reference teaches or suggests a stressed film that concentrates compressive forces at a boundary.

With regard to claim 19, while Guldi appears to show a pFET and nFET, Ahmad does not, and cannot, answer the remaining recitations of the claim; and, the Examiner does not suggest that it does. As previously indicted, Guldi and Ahmad are not properly combinable primarily because *Ahmad does not address any sort of diffusion rate control.* As such, Ahmad does not, and cannot, answer the recitations of a pFET boron diffusion concentration profile corresponding to a lower boron diffusion rate than such a profile in an nFET.

Yeo is cited for teaching a stressed film is a tensile film. However, the silicon nitride film 216 lines trench isolation structures 214, and *not* a structure on a surface of semiconductor material as clearly recited in claim 13. Thus, Yeo cannot be used in combination with Guldi to reject any claim in the present invention because it does not answer the explicit recitations of claim 13 and, further, because neither reference teaches or suggests a stressed film that concentrates compressive forces at a boundary.

In summary, the grounds of rejection asserted in the office action are in error in regard to the claims as currently rejected or now amended since the references cited by the Examiner does not teach or suggest the novel features of the claimed invention, either as originally filed or as currently amended. For these reasons, it is respectfully submitted that the level or ordinary skill in the art determinable from the references relied upon is clearly insufficient to support a prima facie demonstration that any claim in the application is anticipated or obvious. Therefore, it is respectfully requested that the grounds of rejection be withdrawn and claims 1-20 be allowed.

Further, it is respectfully submitted that the above-requested amendments are limited to emphasizing the novel aspects of the invention in accordance with the suggestions by the Examiner without significantly altering the scope thereof and, thus, do not raise new issues. Additionally, entry is well-justified as placing the application in condition for allowance. Accordingly, entry of the above-requested amendments, reconsideration and withdrawal of this grounds of rejection are respectfully requested. If, upon reconsideration, the Examiner finds any issue unresolved by the foregoing and which would prevent immediate allowance of the application, it is respectfully requested that the undersigned be contacted by telephone at the number provided below in order to expeditiously resolve the same.

Since all requirements contained in the outstanding official action have been fully answered and shown to be in error and/or inapplicable to the claims, it is respectfully submitted that reconsideration is now in order under the provisions of 37 C.F.R. §1.111(b) and such reconsideration is respectfully requested. Upon reconsideration, it is also respectfully submitted that this application is in condition for allowance and such action is therefore respectfully requested.

If an extension of time is required for this response to be considered as being timely filed, a conditional petition is hereby made for such extension of time. Please charge any deficiencies in fees and credit any overpayment of fees to Deposit Account No. 09-0458 of International Business Machines Corp. (East Fishkill).

Respectfully submitted,

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